



US Army Corps  
of Engineers

# Incorporation of GSR into Army Environmental Remediation

**Environment, Energy & Sustainability Symposium and  
Exhibition (E2S2)**

May 12, 2011



Kevin Roughgarden, Department of the Army  
Carol Lee Dona, USACE Environmental and Munitions CX  
Nicholas Stolte, USACE Louisville District

<b>Report Documentation Page</b>			<i>Form Approved OMB No. 0704-0188</i>	
<p>Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.</p>				
1. REPORT DATE <b>12 MAY 2011</b>	2. REPORT TYPE	3. DATES COVERED <b>00-00-2011 to 00-00-2011</b>		
4. TITLE AND SUBTITLE  <b>Incorporation of GSR into Army Environmental Remediation</b>			5a. CONTRACT NUMBER	
			5b. GRANT NUMBER	
			5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)			5d. PROJECT NUMBER	
			5e. TASK NUMBER	
			5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>U.S. Army Corps of Engineers (USACE), Environmental and Munitions Center of Expertise (EM CX), 4820 University Square, Huntsville, AL, 35816</b>			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSOR/MONITOR'S ACRONYM(S)	
			11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>				
13. SUPPLEMENTARY NOTES <b>Presented at the NDIA Environment, Energy Security &amp; Sustainability (E2S2) Symposium &amp; Exhibition held 9-12 May 2011 in New Orleans, LA.</b>				
14. ABSTRACT				
15. SUBJECT TERMS				
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>24</b>
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>		
19a. NAME OF RESPONSIBLE PERSON				



# Overview



- OSD GSR Policy
- Headquarters GSR Overview
- Corps of Engineers GSR Study
- Army Headquarters Next Steps



*A former DERP site, Fort Bragg promotes public access to the installation by providing a number of recreational opportunities, such as bird-watching, on its 18-mile All-American Trail, a registered North Carolina Birding Trail, located on remediated land.*

Photo: Elizabeth Evans, Fort Bragg

[www.army.mil/-images/2010/04/20/70522/](http://www.army.mil/-images/2010/04/20/70522/)



# OSD GSR Policy



- August 2009 Office of the Secretary of Defense (OSD) Policy Memo:
  - Consider and implement Green and Sustainable Remediation (GSR) practices “where and when they make sense” (August 10, 2009)
  - DoD Components requested to brief OSD on current efforts, strategies, and future plans

## Green and Sustainable Remediation

**Minimize the overall environmental footprint through the following activities:**

- Evaluate sustainability during remedy selection
- Evaluate sustainability of existing remediation systems
- Preserve natural resources
- Minimize energy use and increase energy efficiency
- Minimize emissions
- Use passive sampling
- Minimize fresh water consumption and maximize water reuse
- Maximize recycling, reuse, and reduction of materials
- Consider use of environmental remediation technologies with inherently sustainable aspects



# Headquarters GSR Overview



- Army GSR Strategy:
  - Sustainability concepts addressed in the 2004 Army Strategy for the Environment
  - Green remediation specifically included in FY10-11 Army Environmental Cleanup Strategic Plan
- Ongoing efforts:
  - Participate and partner with other agencies
  - Conduct Pilot Projects
  - Optimize Existing Remedies
  - Utilize Sustainability Tools



*Colorado Gov. Bill Ritter Jr. and Maj. Gen. Mark A. Graham, commanding general, Division West, First Army and Fort Carson, prepare to cut the ribbon on the 15-acre Fort Carson solar array.*

Photo: Michael J. Pach

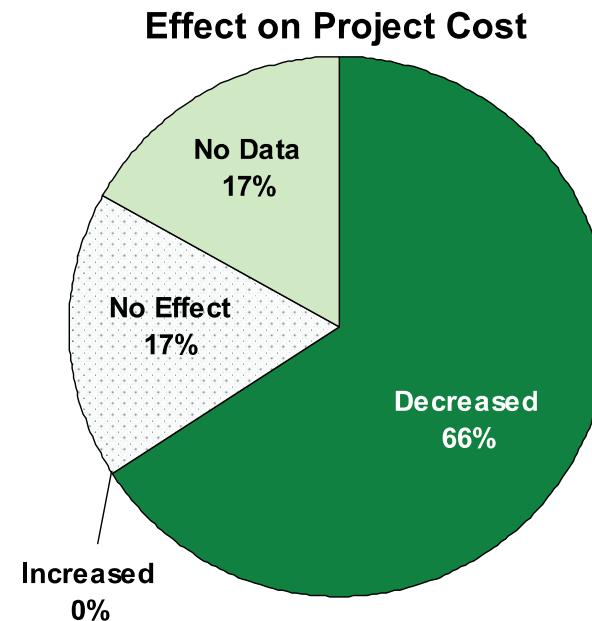
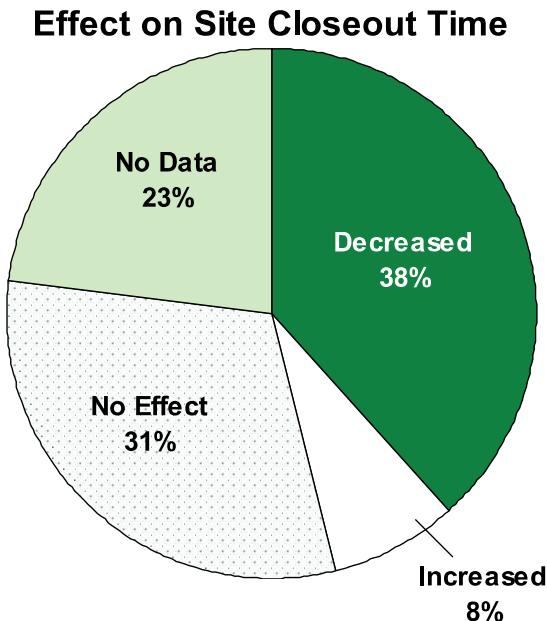
[www.army.mil/-images/2008/01/17/12170/](http://www.army.mil/-images/2008/01/17/12170/)



# GSR In Practice: Field Survey

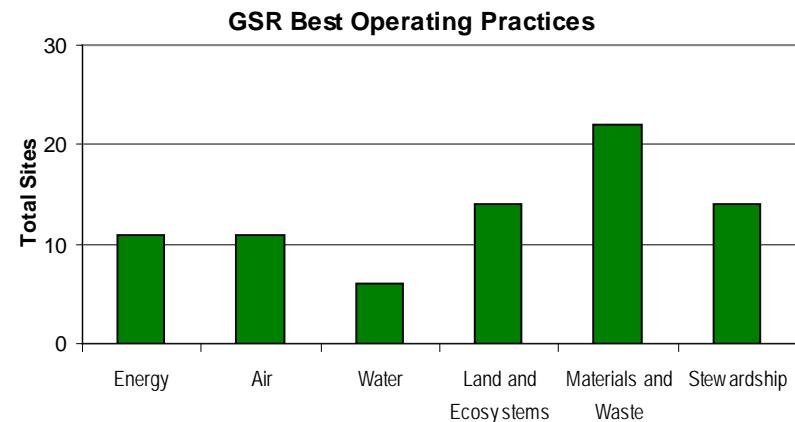
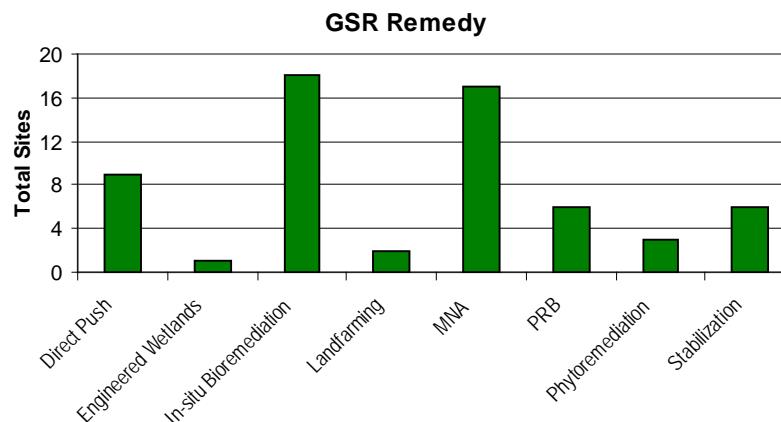
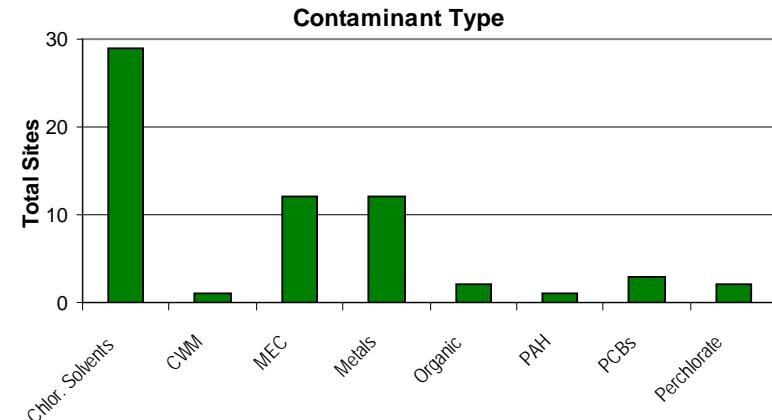
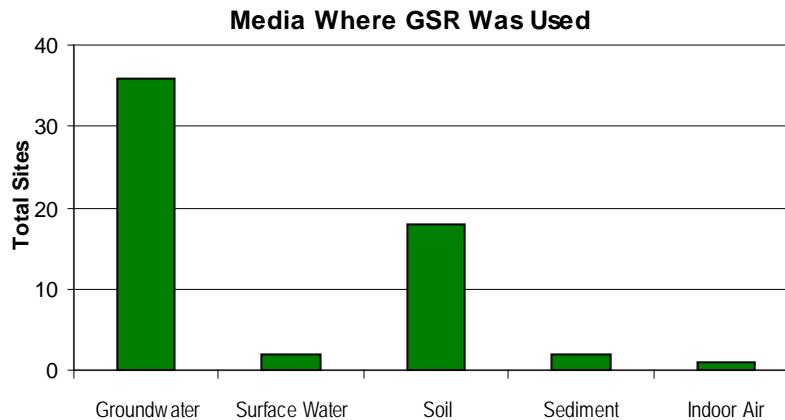


- Army HQ developed a field survey to capture the broad nature and scope of Army GSR practices
- Initial scope: Tasked to all Army Commands (AEC, BRAC-D, HQUSACE, NGB) for distribution to field.
- Received 47 survey responses from 28 installations
- Installations: 12 Active, 8 BRAC, 6 FUDS, 2 NGB





# GSR Remedies and Best Practices



\* Survey respondents were asked to check all that apply, so the sum within each table may be higher than the total number of surveys received.



- Most widely used GSR Remedies include the following:
  - On-Site Treatment
    - In-Situ Soil Treatment (133 sites)
    - Ex Situ Soil Treatment (114 sites)
    - Solidification/Stabilization (58 sites)
    - Soil Washing (9 sites)
  - Treatment that Mimics a Natural Process
    - Natural Attenuation (501 sites)
    - Bioremediation (154 sites)
    - Bioremediation – In Situ Groundwater (126 site)
    - Bioremediation – In Situ (62 sites)
    - Bioventing (41 sites)
    - Passive Treatment Wells (33 sites)
    - Composting (32 sites)
    - Landfarming (12 sites)
    - Alternate Habitat (3 sites)
    - Slurry-Phase Bioremediation (3 sites)

*Because of limited GSR data reported in current data systems, not all sites using green or sustainable remedies are reflected in this list*



# GSR Study



- Army funded a study with the Corps of Engineers to provide the information necessary and the recommendations for the consideration and/or development of Army-wide Green and Sustainable Remediation (GSR) guidance and policy
- Study Description:
  - Follow the consideration and incorporation of GSR practices into Army environmental remediation projects
  - Ascertain the effectiveness of the GSR practices that are considered and incorporated
  - Provide procedures by which GSR practices that are shown to be effective can be identified, considered, implemented and documented by Project Teams working on Army sites
  - Study starting with the USACE GSR Interim Guidance ([http://www.environmental.usace.army.mil/pdf/IG%2010-01%2003\\_05\\_10%20doc.pdf](http://www.environmental.usace.army.mil/pdf/IG%2010-01%2003_05_10%20doc.pdf).) and will revise the procedures per the Study results



US Army Corps  
of Engineers®

# Study Team

## OACISM

- Kevin Roughgarden

## USACE Environmental and Munitions CX

- Carol Dona (PM)
- Nick Stolte and Deborah Walker (MMRP)

## Tetra Tech (Contractor to USACE)

- Rob Greenwald (project manager)
- Doug Sutton (IRP GSR lead)
- Michelle Caruso (MMRP GSR lead)

## Others

- Army National Guard Bureau (NBG)
- Army Environmental Command (AEC)
- Deputy Assistant Secretary of the Army for Environment, Safety, and Occupational Health [DASA(ESOH)]
- Formerly Used Defense Sites (FUDS)
- Military Munitions Support Services (M2S2)
- USACE Engineering and Support Center, Huntsville
- Army Environmental Policy Institute (AEPI)



# Study Process



- 12 Army environmental remediation projects/pilots: GSR practices identified and the consideration, incorporation, and documentation by the PT followed
- Projects chosen across Army components (FUDS, BRAC, IRP, National Guard), across IRP and MMRP programs, and across remedial phase (planning to site closeout)
- GSR evaluation report identifying potential GSR opportunities supplied to project team
- Study team follows and documents project team GSR consideration and incorporation – what makes sense and when and where



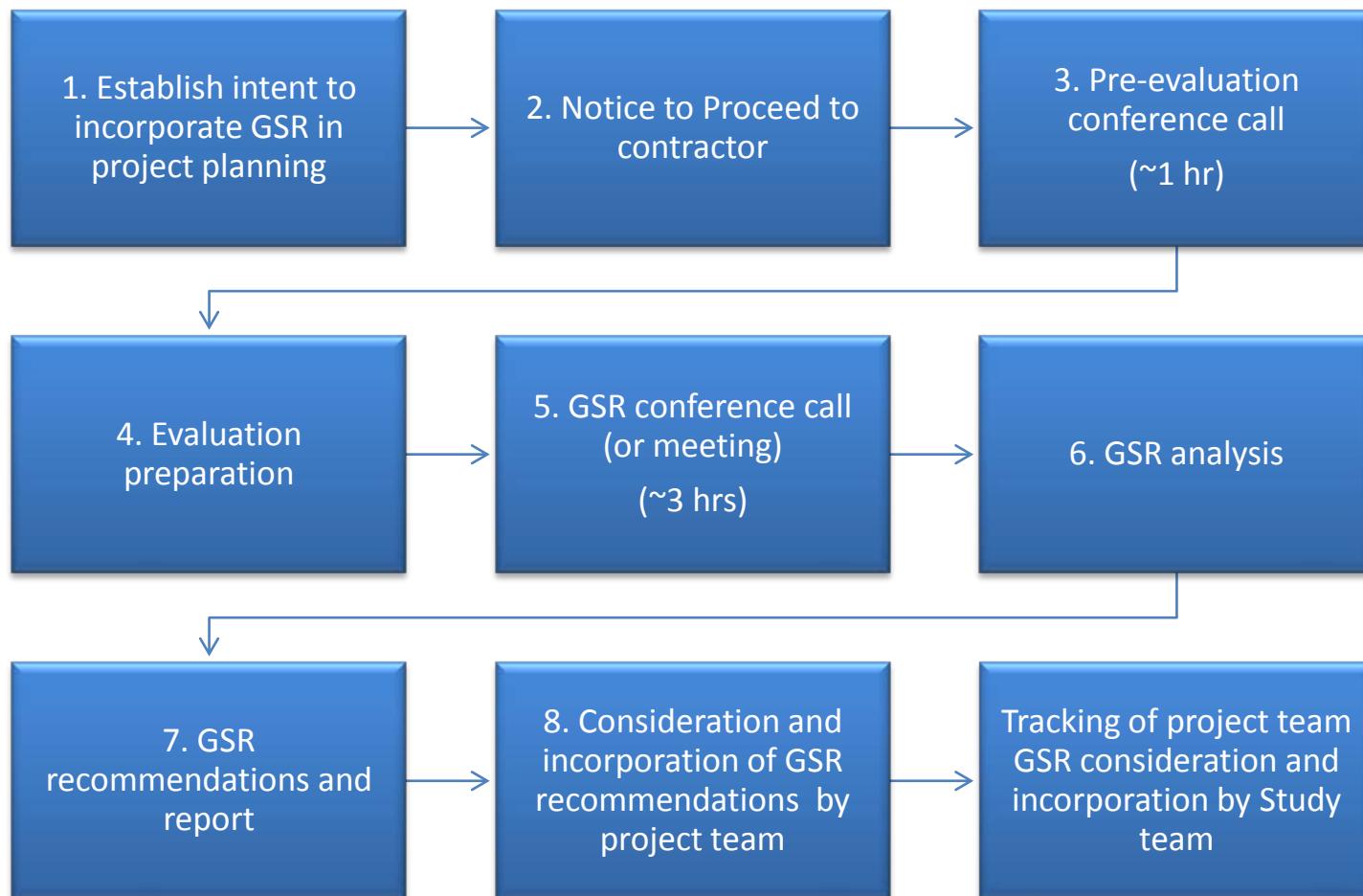
# Pilot GSR Projects for Study



Project Description	Program	Phase
Pump and Treat (P&T) with MNA	IRP – FUDS	RD
P&T Replacement (PRB and/or MNA)	IRP – BRAC	FS/ESD/RD
Consolidation/Capping of Landfill	IRP – FUDS	RD
Petroleum Soil Remediation	IRP – NGB	RA
Munitions Remediation	MMRP – NGB	RI/FS
In-situ Bio/MNA	IRP – Active Army	FS
Munitions Remediation	MMRP – Active Army	FS
Chemical Warfare Material Remediation	MMRP – FUDS	RI/FS
Optimization P&T's, Source Removal	IRP – Active Army	RA-O
MNA w, w/o Source Removal	IRP – FUDS	Post FS (PP)
SI/RI Planning	IRP – FUDS	SI/RI



# GSR Approach (Steps) Implemented in the Study





# Schedule for Each Pilot

Task	Duration of Task	Days from "Step 5" Call/Meeting
Introductory Teleconference (Step 3 Call)	~1 hour	N/A
Kick-off Teleconference (Step 5 Call/Meeting)	~3 hours	0
Draft GSR Evaluation	21 days	21
Comments from USACE	10 days	31
Draft Final GSR Evaluation	10 days	41
Comments from USACE, ACSIM, Project Team	21 days	62
Final GSR Evaluation	10 days	72

*For some of the pilots an expedited schedule without the first draft has been requested so that the GSR findings can be available sooner*



# Ways GSR Can Be Incorporated

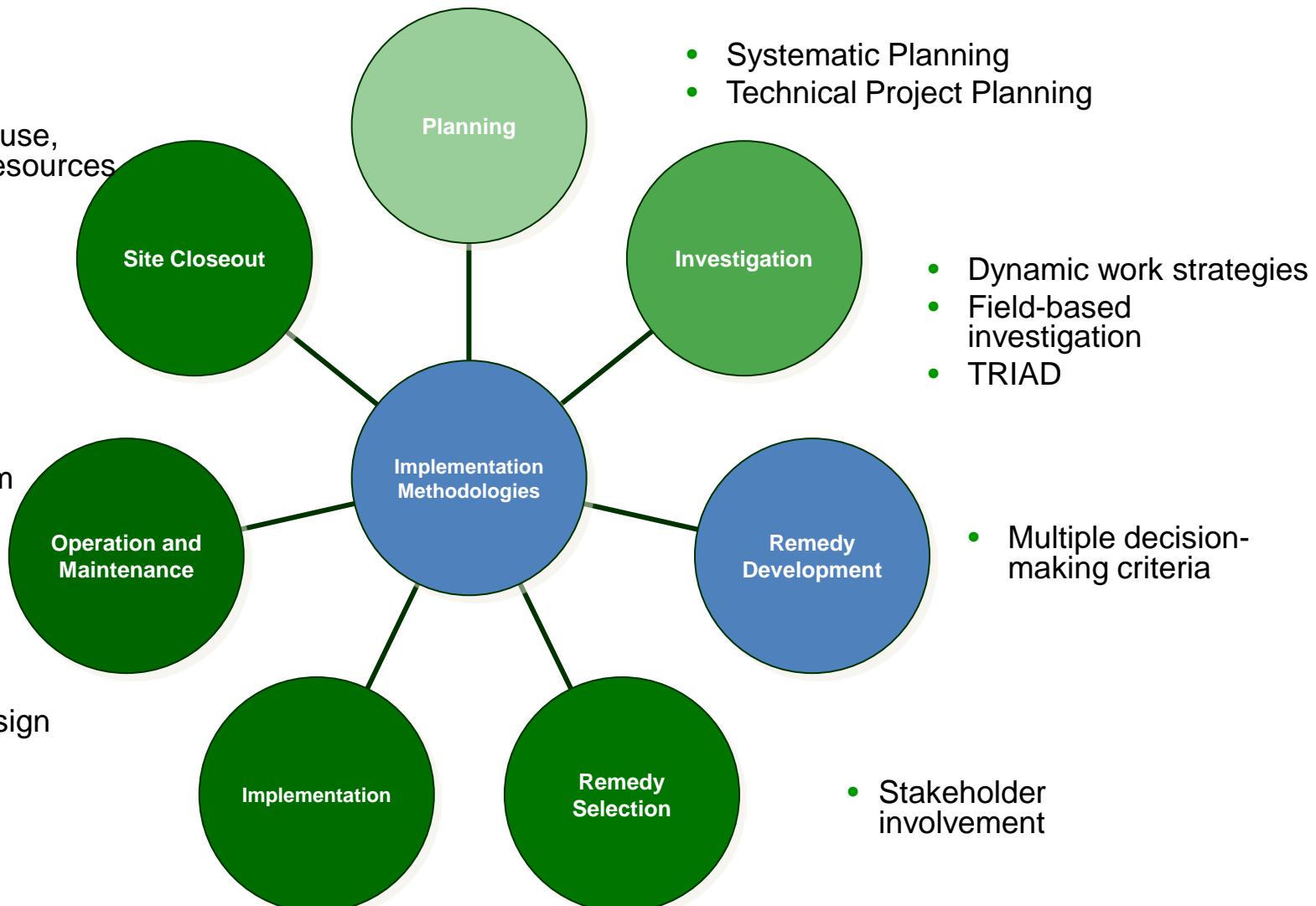


- Methodologies
  - Systematic Planning
  - Dynamic and multi-criteria decision making
  - Independent Review
  - Stakeholder Involvement
  - Maximize Site Reuse/Materials
- Best Management Practices
- GSR Quantitative Footprints for Comparison of Different Options



# Methodologies

- Maximize site reuse, materials, and resources
- Remedial system optimizations
- Independent design review





# Pilot Example of Methodology Application: Independent Design Review



## Recommendation

Design P&T to address two plume lobes with separate treatment plants rather than one centrally located treatment plant, plus implement VFDs for extraction pumps

## Basis for Recommendation

Eliminates ~20,000 ft of piping and associated piping. Lowers electrical use due to reduced pumping head plus use of VFDs. Provides greater treatment flexibility. Requires an extra building and some duplicate equipment.

## Resources Conserved

Reduces footprints over remedy lifetime (30 years) such as:

- Electricity usage – 12 million kWh
- Energy – 120,000 MMBtu
- CO2e – 10,000 metric tons
- NOx - 20 metric tons
- SOx - 30 metric tons
- HDPE – 600,000 lbs

## Estimated Costs/Savings

Up-Front Savings ~\$609,500

Payback Period: Immediate

Annual Savings ~\$27,000/yr

Lifecycle Savings ~\$1,100,000 NPV



# GSR BMPs



- Many different categories of BMPs
  - Planning
  - Characterization and/or Remedy Approach
  - Energy/Emissions - Transportation
  - Energy/Emissions - Equipment Use
  - Materials & Off-Site Services
  - Water Resource Use
  - Waste Generation, Disposal, and Recycling
  - Land Use, Ecosystems, and Cultural Resources
  - Safety and Community
  - Other Site-Specific BMPs
- Example BMPs
  - Reduce idling time for construction equipment
  - Select transportation routes for trucks and heavy equipment that minimize impacts to residential areas to maximize safety and minimize noise and other aesthetic impacts



# Pilot Example of BMP Application: Electronic Deliverables



<b>Recommendation</b>	
Submit report appendices and lab reports on CD	
<b>Basis for Recommendation</b>	
• Annual report is distributed in both hard copy and electronic forms	
• Recommended that lab data and other appendices be distributed electronically instead of hard copy	
<b>Resources Conserved</b>	
Saves paper, shipping, storage space	
Qualitatively reduces hazardous air pollutants, criteria pollutants, GHG emissions, energy, materials, and water (not specifically quantified)	
<b>Qualitative Cost Impact Over 5 Years</b>	<b>Level of Up-Front Investment</b>
Cost Savings	Negligible



US Army Corps  
of Engineers

# Quantitative GSR Footprints

- Need GSR Evaluation Tool
  - Publicly Available tools
    - Air Force Sustainable Remediation Tool (SRT), developed by AECOM, GSI, and CH2MHill  
<http://www.afcee.af.mil/resources/technologytransfer/programsandinitiatives/sustainableremediation/srt/index.asp>
    - SiteWise™ Green and Sustainable Remediation (GSR) Tool, co-developed by Battelle, the Navy, the Army, and the USACE  
[www.ert2.org/t2gsrportal/tools.aspx](http://www.ert2.org/t2gsrportal/tools.aspx)
  - SiteWise™ primary tool used in Study
    - Information such as material use, vehicles and distances for transportation, and equipment use is obtained from the project
    - The information is entered into tables on an “input sheet” by typing values and using drawdown menus
    - SiteWise™ uses conversion factors to calculate GSR parameters based on the input
    - For metrics not in SiteWise™ manual calculations are performed, including upfront cost, discounted and undiscounted total costs, and payback periods



# Example of Quantitative GSR Footprint: Use of Variable Frequency Drives



Recommendation	
Include VFDs for air stripper blower motor	
Basis for Recommendation	
Reduces footprints for energy use, CO2e, criteria pollutants, and water used to generate electricity. Requires minimal up-front cost, and has a payback period of approximately 3 years. Does not appear to have any significant negative impacts.	
Resources Conserved	
Reduces footprints over remedy lifetime (30 years) by the following amounts:	
<ul style="list-style-type: none"><li>• Electricity Usage - 1.5 million kWh</li><li>• Energy - 16,000 MMBtu</li><li>• CO2e - 1,300 metric tons</li><li>• NOx - 2.6 metric tons</li><li>• SOx - 4.5 metric tons</li><li>• Water - 770,000 gallons</li></ul>	
Estimated Costs/Savings	
Up-Front Cost ~\$7,500	Payback Period <3 yrs
Annual Savings ~\$3,300/yr	Lifecycle Savings ~\$57,000 NPV



US Army Corps  
of Engineers®

# Overall Study Schedule

Task	FY10	FY11				FY12
	Q4	Q1	Q2	Q3	Q4	Q1
Develop Process for Applying GSR						
GSR Evaluations for 12 Pilot Projects						
Draft and Final Study Report						

- One combined GSR process for IRP and MMRP projects; process will be applied/tested for pilot projects
- Process will be modified and finalized in Study Report based on findings from pilot projects
- Study Report will have recommendations for Army-wide guidance and policy, also revisions to USACE GSR interim guidance



# Current Study Status



## Current Project Status

Draft Final Study Approach Completed (will be modified with Study Results for approach to be used by Army project teams)

### Projects

Project Stage	No. of Projects
Project teams agree to participate in Study	12
Introductory Step 3 calls completed	11
Step 5 calls scheduled/completed	6/5
Draft GSR evaluation reports completed, in review by project teams	5
GSR incorporation complete	1



# Army HQ Next Steps



## Guidance

- Incorporate GSR guidance into the Army DERP manuals
- Evaluate need for specific Army GSR guidance
- Determine applicability of USACE Decision Framework to larger Army environmental remediation program

## Resources and Case Studies

- Create a information exchange through Army Sustainability Web site housing GSR guidance, practices, tools and other available resources
- Continue to develop and test process for GSR consideration and implementation
- Develop and standardize GSR contract language

## Performance Measures

- Continue developing standardized performance measures (metrics)
- Incorporate metrics in revised and new Army databases



# Questions?



Kevin Roughgarden  
Department of the Army,  
Office of the Assistant Chief of Staff for Installation Management  
[kevin.roughgarden@conus.army.mil](mailto:kevin.roughgarden@conus.army.mil)

Carol Dona  
US Army Corps of Engineers  
Environmental and Munitions Center of Expertise  
[Carol.L.Dona@usace.army.mil](mailto:Carol.L.Dona@usace.army.mil)